Cummins, of the Fort Leavenworth Agency, reported to the Government: "All those farming on the bottom lands of the Kansas River and other bottom lands lost their crops entirely, and not only their crops, but nearly all their stock, hogs, cattle, and even horses. * * * The Konzas farm is mostly on the bottom lands of the Kansas River, which was overflowed from bluff to bluff." S. M. Irvin, Indian Agent in charge of the Great Nemaha Subagency, reported: "The past season, you must be aware, has been a most unpropitious one for farming operations. The unprecedented fall of rain which took place in June and July, by which much of the best farming land of the Indians was several times inundated, has been a serious drawback upon the aggregate value of the farming products."

W. W. Cone in his "Shawnee County History", speaking of the flood of 1844, says: "During the flood Major Cummings, Paymaster of the U. S. Army, wishing to cross from the south to the north side of the Kaw River at Topeka stepped into a canoe at about the present site of the corner of Topeka avenue and Second street and was rowed by an Indian from there to the bluffs, near the present residence of J. M. Harding, in Soldier township, the water then being 20 feet deep over the ground where North Topeka now stands".

Mr. P. E. Chappell, of Kansas City, Mo., an old river steamboatman, states that the flood of 1844, in the Missouri River, was confined to the lower river and adds: "The entire bottom from the Kaw to the mouth of the Missouri was completely submerged, and from bluff to bluff presented the appearance of an inland sea". He further states that in 1845 and in 1851 there was unusually high water in the river and all the second bottoms and low slough were submerged. We find that at Fort Leavenworth 15.80 inches of rain fell during June, 1845, while in 1851 the Fort Leavenworth record shows for May 6.40 inches, for June 8.16, July 6.78, and August 5.02, a total of 26.36 inches.

THE DROUGHT.

Mr. E. C., in his paper "In at the birth, and–" says in part: "During the winter of 1859-60, the sun shone forty-five consecutive days thro a cloudless sky upon a snowless plain. Thru the summer of 1860 the hot wind parched the soil and no harvest followed the seed time; hence the approaching winter brought an alarming outlook". (He was living in Marshall County then.)

Mr. Wm. H. Coffin, who settled in Leavenworth County in the 50's, speaking of the drought, says in part: "In the great drought in Kansas, from June 19, 1859, to November, 1860, not a shower of rain fell at any one time to wet more than two inches deep, and but two light snows in the winter ('59-60). Roads never got muddy, and the ground broke open in great cracks. There were no vegetables whatever, and a burning hot wind in July and August withered everything before it. Fall wheat came up in the spring but withered and died; most counties did not harvest a bushel. Low bottom lands, where well tilled, gave some corn, but most other lands dry fodder. Prairie grass grew until July, then all withered and died—enough was secured mostly from low bottom lands. Wells, springs, and streams dried up".

The Hon. Geo. W. Martin, in an address before the Old Settlers' Association of Geary County, September 21, 1901, said in part: "The changed condition in Kansas is indicated by the tone of the people during the recent dry spell. It is no easy matter to reclaim a new country, but the people of Kansas have accomplished marvels. The drought of 1860 began September 1, 1859, from which date there was no rain until September or October, 1860. * * * On the 13th of July the mercury went up to 112° and 114° in the shade (the highest temperature at Manhattan was 115°), and, with a hot scorching wind, it kept at these figures for weeks. The leaves withered and fell off the trees, and eggs roasted in the sand at midday. The dates of the beginning and ending of the drought vary in locations, but it may be said that there were from twelve to fourteen months between rains".

Horace Greeley, writing in the New York Independent of February 7, 1861, referring to the drought of the preceding year, said: "* * * Drought is not unknown to us; but a drought so persistent and so severe as that which devastated Kansas in 1860 is a stranger this side of the Mississippi. No rain, or none of any consequence, over an area of 40,000 square miles, from seed time till harvest—wheat, Indian corn, buckwheat, successively deposited in the earth, to die without germination, or to start only to be blighted and wither for want of moisture".

Mrs. Susie M. Weymouth, in the Daily Capital, July 19, 1901, says: "The drought of 1860 gave to Kansas the ignominous name, 'droughty Kansas'. * * * It seemed for a time that the powers of heaven and earth were against us. * * * Previous to 1860 a good many trees were planted. The hot winds of that summer told on them, and in after years the south side of the trees told of the fearful heat which they had past thru, for there was always a dead part. That year will go down in history as having the hottest day on record. * * * It was in July * * * a frightful day. People fled to their cellars and every door and window was closed. It was as if the wind was coming from a red-hot furnace for nine or ten hours. Next day we looked to see what damage it had done—birds, chickens, and stock had succumbed and the trees were badly injured; the tender things for two feet on the south side were as dead as if a fire had swept thru them".

The year 1874 has been called a drought year, but it was not; it was a grasshopper year.

CLAYDEN'S CLOUD STUDIES.

As we often have occasion to refer to the volume entitled "Cloud Studies", by Arthur W. Clayden,[1] it seems proper to call the attention of American observers and students to this excellent work, which in some respects supplements the important papers published by our American colleague, Mr. H. H. Clayton, of Blue Hill Observatory. Mr. Clayden has been a long time known to meteorologists as the secretary of the special committee on meteorological photography, of the British Association for the Advancement of Science, and he has published annual reports on that subject since 1890. He was a wrangler in the Tripos, Christ College, Cambridge, 1876, and science master at Bath College, 1878, and is now principal of the Royal Albert Memorial College, Exeter; he is therefore thoroly familiar with the physical problems that enter into cloud study, and with the laboratory methods necessary to secure good photographs and accurate measurements. His present volume shows that perfect familiarity with the subject that enables one to write "down to the level of the nontechnical reader" without making any technical mistakes; so that this book will be for a long time treasured as one worth reading and studying. The work is not merely a collection of halftones, with descriptions of the clouds, but it is full of suggestions as to their methods of formation, and will stimulate the reader to further studies. It is the work of an independent thinker, who does not often go far astray from the facts and principles that belong to exact science.

Some items that have caught our attention may be worth mentioning, but really every one of the 180 pages contains something good.

On page 16 the author urges the advantage of observing delicate details by studying the reflection of a cloud in a black glass mirror; we are sorry to find that his book is so wholly taken up with photographic work that he has, we believe, not even mentioned the nephoscope and the ordinary use of the

[1] Published by John Murray, London, 1905.

black mirror in that instrument. Of course the nephoscope and its methods are crude compared with photography, but it should be in everyone's hands, even if one also has a photogrammeter.

In the introduction Mr. Clayden indicates the need of a much more elaborate system of names for clouds than is afforded by the simple international system. He would like to have that considered as a list of the names of cloud *genera* and as open to elaboration by the insertion of specific names for varieties, whose peculiarities depend upon the conditions under which they are formed. The present writer would add that in August, 1895, at the meeting of the American Association for the Advancement of Science, at Springfield, Mass., he submitted quite an elaborate system of notation and symbols (as being better than a list of Latin names), by which he was able to indicate to the eye at a glance many of the conditions leading to the formation of any special variety of cloud. It was a sort of picture writing that would appeal to everyone, and be adaptable to all possible combinations, and could easily become an international system. The discussion that followed the presentation of the paper was so discouraging that the author has refrained from publishing it, but may do so at some future time, as it partially meets the needs indicated by Mr. Clayden.

Sixteen varieties or genera of clouds were recognized by the International Cloud Atlas, and 35 additional varieties or species, with their names, occur in the course of Mr. Clayden's volume, all of which are systematically arranged in his tenth chapter; we quite agree that, as the author suggests, further additions, and in fact numerous ones, must be made when we come to study clouds in other climates than that of England.

Apparatus and photographic methods are described in the latter part of the book, so that anyone may begin at once to follow in the author's footsteps. Historical matters are mentioned in the introductory chapter, but our special interest is attracted by the material published in Chapters II–VIII. Beginning with the cirrus cloud Clayden mentions that the loftiest variety, which he calls the cirrus-excelsus, is visible like a silvery curtain when the whole sky is so dark that third and fourth magnitude stars are visible. This is the so-called phosphorescent cloud, or nocti-luminous cloud, but it is not likely that the cloud is self-luminous; it is more likely that it is visible by its reflection of very distant twilight. The highest altitude obtained for a specimen of this cloud is given on page 32 as 17.02 miles, or more than 27,000 meters, on the afternoon of June 12, 1899, at Exeter. But on page 150 the same cloud apparently is spoken of as observed one morning, on a day of very hot, damp weather, at the altitude of 27,413 meters, or about seventeen miles. We believe that there is only one observation of this kind of cloud on record in the United States.[1] Of course at this altitude clouds formed of aqueous particles, whether water or ice, are extremely improbable and not likely to be dense enough to be visible. The rate of diminution of vapor pressure with ascent is such that visible clouds more than fifteen miles high must be of the rarest occurrence. But on the other hand clouds of meteoric matter are very common, and it is worth inquiring whether our noctiluminous clouds, or cirrus excelsus, may not be of some such foreign origin, like the auroral clouds and other phenomena that are supposed to depend upon the electrons of cosmic space.

In Plates XX and XXI Clayden gives companion pictures taken within a half minute of each other, looking toward the west and the northwest, respectively, giving us a panorama of the western sky while the sun was nearing the horizon. The photographs, therefore, represent the under surface of a sheet of hazy cirro-cumulus illuminated by the setting sun. The gorgeous sunset colors on these clouds can not be given. The clouds themselves were composed of icecrystals that had a half hour previously given rise to a solar halo.

Numerous references to the relations between clouds and subsequent weather are given. Thus on page 81 Clayden states that he has made a series of measurements of the thickness of clouds necessary to the production of a shower of rain. In winter no rain will fall from a cloud unless its thickness is at least a hundred meters; in summer the thickness must be rather greater. If, however, the temperature is so low that the cloud is formed only of flakes of snow, then this may fall from a layer of thin lifted fog not quite thick enough to hide the blue color of the sky. Under ordinary conditions of temperature rain is unlikely, or small and trifling, if the thickness is less than two thousand feet or six hundred meters. The heaviness of the rain and the size of the drops increase with the thickness of the cloud. If the height from base to summit be two or three thousand feet the fall will be gentle; four thousand to six thousand feet gives large drops and a fairly heavy shower; six thousand to ten thousand feet in the summer time gives cold heavy rains and hail. In general the rain cloud does not differ in any way from the rainless, except in thickness.

In the same connection (on page 96), speaking of the cumulus Clayden adds that small cumuli, less than one hundred and twenty meters thick, rarely produce rain, and nothing like a heavy shower is likely unless the thickness exceeds four hundred meters. As the cumulus drifts over the landscape it seldom maintains its showery character for more than ten or fifteen miles, often for much less. Its activity as a rain producer is checked by the checking of the ascending currents of air, both by the mechanical action of the falling raindrops and by the cooling influence of these drops on the lower part of the ascending column. The formation of long trains of cumuli in connection with the hills or other orographic features, is fairly well explained, but we hardly agree with Clayden's suggested explanation of the fact that the relative humidity within clouds and fogs is generally observed to be less than 100 per cent.

Chapter VIII is given up to wave clouds, and suggests many problems for both the observer, the experimentalist, and the mathematician.—*C. A.*

WEATHER BUREAU MEN AS EDUCATORS.

The following lectures and addresses by Weather Bureau men are reported:

Mr. M. E. Blystone, December 18, 1906, before the Franklin Society of Providence, R. I., on "The Work of the Weather Bureau".

Mr. N. B. Conger, of the Detroit, Mich., office, December 6, 1906, before the Windsor Literary and Science Club, of Windsor, Ont., on "The Weather Bureau and its Work".

Mr. P. Connor, October 11, 1906, before the pupils of the Manual Training High School, Kansas City, Mo., on weather topics; also December 16, 1906, before a bible class of the Independence Avenue Methodist Church, on "Meteorological Instruments and Weather".

Mr. H. W. Richardson, December 12, 1906, before the Men's League of the First Methodist Church, Duluth, Minn., on "The U. S. Weather Bureau"; also December 28, 1906, before the Northern Railway Club, on "Weather in its Relation to Railroad Operations".

Mr. J. Warren Smith, November 30, 1906, before the Ohio Academy of Science, at its annual meeting, in Columbus, Ohio, on "Weather and Crop Yield".

Classes from schools and academies have visited Weather

[1] See the Monthly Weather Review for December, 1904, page 560, where Rev. W. S. Rigge records an observation made on July 18, 1904, at Omaha, but the altitude is not stated.